

| <b>Notice of Allowability</b> | <b>Application No.</b>   | <b>Applicant(s)</b> |  |
|-------------------------------|--------------------------|---------------------|--|
|                               | 10/650,362               | GANESH ET AL.       |  |
|                               | Examiner<br>Dieu-Minh Le | Art Unit<br>2114    |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1.  This communication is responsive to the interview on 2/20&2/23/07 & TD filed on 03/01/07.
2.  The allowed claim(s) is/are 1,3-15, 31-44 [now as 1-28].
3.  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a)  All
  - b)  Some\*
  - c)  None
  1.  Certified copies of the priority documents have been received.
  2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3.  Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4.  A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5.  CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
  - (a)  including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
    - 1)  hereto or 2)  to Paper No./Mail Date \_\_\_\_\_.
  - (b)  including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6.  DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

#### Attachment(s)

1.  Notice of References Cited (PTO-892)
2.  Notice of Draftsperson's Patent Drawing Review (PTO-948)
3.  Information Disclosure Statements (PTO/SB/08),  
Paper No./Mail Date 1/23/04 & 11/16/06
4.  Examiner's Comment Regarding Requirement for Deposit of Biological Material
5.  Notice of Informal Patent Application
6.  Interview Summary (PTO-413),  
Paper No./Mail Date \_\_\_\_\_.
7.  Examiner's Amendment/Comment
8.  Examiner's Statement of Reasons for Allowance
9.  Other \_\_\_\_\_.

DIEU-MINH LE  
PRIMARY EXAMINER  
*Dieu Minh Le*

Art Unit: 2114

1. This office action is in response to the Interview on 02/20/2007, 02/23/2007 and the Terminal Disclaimer filed on 03/01/07.

2. Claims 1, 3-15, 31-44 [now as 1-28] are allowable over the prior art of record [claims 2, 16-30 have been canceled; claims 31-44 have been added].

3. An Examiner's Amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 C.F.R. § 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the Issue Fee.

**EXAMINER'S AMENDMENT:**

**IN THE CLAIMS:**

Please replace all prior versions of claims in the application with the current listing claims in the

**ATTACHMENT:**

Art Unit: 2114

4. Authorization for this Examiner's Amendment was given in a telephone interview with Mr. Marcel K. Bingham, Registration No. 42,327 on 02/20/2007 and 02/23/2007.

Any comments considered necessary by applicant must be submitted no later than the payment of the Issue Fee and, to avoid processing delays, should preferably **accompany** the Issue Fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dieu-Minh Le whose telephone number is (571) 272-3660. The examiner can normally be reached on Monday - Thursday from 8:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Scott Baderman can be reached on (571) 272-3644. The Tech Center 2100 phone number is (571) 272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



DIEU-MINH THAI LE  
PRIMARY EXAMINER  
ART UNIT 2114

DML.

03/02/2007

**ATTACHMENT:**

LISTING OF CLAIMS:

1. (Currently Amended) A method for applying changes in redo records to make a particular resource reflect changes made to the particular resource in volatile memory before a failure from a log that reflect changes to a plurality of resources, the method comprising the steps of:  
for each resource of said plurality of resources,  
establishing links that link together a set of redo records that contain changes made to the particular resource; and  
for a particular resource of said plurality of resources, applying changes in the respective set of redo records to cause a particular resource to reflect changes made to the particular resource in volatile memory before a failure;  
wherein the step of applying changes includes  
following the respective links established for the particular resource to apply the changes contained in the respective set of redo records to cause the particular resource; and

wherein establishing links that link together the set  
of redo records for each resource of said  
plurality of resources is performed prior to  
reflect the changes made to the particular  
resource in volatile memory before the failure.

2. (Cancelled)

3. (Currently Amended) The method of Claim 1, wherein the step of following the links to apply the changes contained in the set of redo records is performed in response to a transaction requesting, subsequent to the failure, access to the particular resource subsequent to the failure.

4. (Currently Amended) A method for applying changes in redo records to make a resource available, wherein the resource is locked by a dead transaction, the method comprising the steps of:

(A) identifying a redo record in a block-basebased redo chain, wherein the redo record contains least recent changes made as of a particular

checkpoint time that need to be applied to the resource;

(B) applying the least recent changes contained in the redo record to the resource; and

(C) repeating steps (A) and (B) until all changes that are contained in redo records in the block-  
basebased redo chain have been applied to the resource.

5. (Original) A method for applying changes in two or more undo records in parallel, wherein a plurality of resources are locked by a dead transaction, the method comprising the steps of:

identifying, within a single undo log file, a plurality of sets of undo records, wherein each set of undo records of said plurality of sets of undo records does not contain any undo record that depends on any undo record in any other set of undo records of said plurality of sets of undo records; and

applying the plurality of sets of undo records in parallel relative to one another.

6. (Original) The method of Claim 5, further comprising establishing the plurality of sets of undo records by performing steps that comprise: among the plurality of sets of undo records: assigning all undo records that are associated with a first resource to a first set of undo records; and assigning all undo records that are associated with a second resource to a second set of undo records.

7. (Original) The method of Claim 6, wherein: the step of assigning all undo records that are associated with the first resource includes the step of linking in a first chain undo records that contain changes that are associated with the first resource; and the step of assigning all undo records that are associated with the second resource includes the

step of linking in a second chain undo records that contain changes that are associated with the second resource.

8. (Original) The method of Claim 7, wherein:  
the step of linking in the first chain undo records that contain changes that are associated with the first resource includes the step of generating a first block-based undo chain, wherein the first block-based undo chain contains undo records that contain changes that need to be applied to the first resource; and  
the step of linking in the second chain undo records that contain changes that are associated with the second resource includes the step of generating a second block-based undo chain, wherein the second block-based undo chain contains undo records that contain changes that need to be applied to the second resource.

9. (Original) A method for linking undo records, the method comprising the steps of:

identifying an undo record, wherein the undo record contains change information that is associated with a particular resource;

linking the undo record into an undo record chain, wherein the undo record chain contains only undo records that contain change information that is associated with the particular resource; and wherein the step of linking the undo record includes generating identifying data in at least one of the records in the undo record chain or in the undo record, wherein said identifying data once generated identifies a particular record in the undo record chain.

10. (Original) The method of claim 9, wherein: the step of identifying the undo record includes the step of identifying an undo record that contains change information that is associated with a particular data block; and the step of linking the undo record into the undo record chain, includes the step of linking the undo record into the undo record chain, wherein

the undo record chain contains only undo records that contain change information that is associated with the particular data block.

11. (Original) The method of claim 9, further comprising the steps of:

identifying a first undo record, wherein relative to the undo record chain the first undo record contains the least recent change information that needs to be applied to the particular resource;

and

linking a pointer in the first undo record to the undo record chain.

12. (Original) The method of claim 9, further comprising the steps of:

identifying a last undo record, wherein relative to the undo record chain the last undo record contains the most recent change information that needs to be applied to the particular resource;

and

linking a pointer in the last undo record to the undo record chain.

13. (Original) The method of claim 9, wherein the undo record chain contains only undo records that contain change information that needs to be applied to the particular resource.

14. (Original) A method for recovering after failure of a transaction, the method comprising the step of: prior to said failure, storing in a first recovery record data that reflects a first change made by the transaction to a first resource; after making said first change and prior to said failure, storing in a second recovery record data that reflects a second change by the transaction to a second resource; after making said second change and prior to said failure, storing in a third recovery record data that reflects a third change to said first resource; after said failure, recovering said transaction; and

wherein the step of recovering said transaction includes applying said data in said first recovery record and said data in said third recovery record prior to applying said data in said second recovery record.

15. (Original) The method of claim 14, wherein:

the step of storing in a first recovery record comprises the step of storing in a first undo record;

the step of storing in a second recovery record comprises the step of storing in a second undo record;

the step of storing in a third recovery record comprises the step of storing in a third undo record; and

the step of applying said data comprises the step of applying said data in said first undo record and said data in said third undo record prior to applying said data in said second undo record.

16. - 30. (Cancelled)

31. (New) A computer-readable storage medium  
storing one or more sequences of instructions  
for applying redo records from a log that  
reflect changes to a plurality resources,  
wherein execution of the one or more sequences  
of instructions by one or more processors  
causes the one or more processors to perform  
the steps of:  
for each resource of said plurality of resources,  
establishing links that link together a set of  
redo records that contain changes made to the  
resource;  
for a particular resource of said plurality of  
resources, applying changes in the respective set  
of redo records to cause a particular resource to  
reflect changes made to the particular resource  
in volatile memory before a failure;  
wherein the step of applying changes includes  
following the respective links established for  
the particular resource to apply the changes

contained in the respective set of redo records;

and

wherein establishing links that link together the set of redo records for each resource of said plurality of resources is performed prior to the failure.

32. (New) The computer-readable storage medium of Claim 31, wherein the step of following the links to apply the changes contained in the set of redo records is performed in response to a transaction requesting, subsequent to the failure, access to the particular resource.

33. (New) A computer-readable storage medium storing one or more sequences of instructions for applying changes in redo records to make a resource available, wherein execution of the one or more sequences of instructions by one or more processors causes the one or more processors to perform the steps of:

- (A) identifying a redo record in a block-based redo chain, wherein the redo record contains least recent changes made as of a particular checkpoint time that need to be applied to the resource;
- (B) applying the least recent changes contained in the redo record to the resource; and
- (C) repeating steps (A) and (B) until all changes that are contained in redo records in the block-based redo chain have been applied to the resource.

34. (New) A computer-readable storage medium storing one or more sequences of instructions for applying changes in two or more undo records in parallel, wherein execution of the one or more sequences of instructions by one or more processors causes the one or more processors to perform the steps of:

identifying, within a single undo log file, a plurality of sets of undo records, wherein each set of undo records of said plurality of sets of undo records does not contain any undo record that depends on any undo record in any other set

of undo records of said plurality of sets of undo records; and

applying the plurality of sets of undo records in parallel relative to one another.

35. (New) The computer-readable storage medium of Claim 34, the steps further comprising establishing the plurality of sets of undo records by performing steps that comprise: among the plurality of sets of undo records: assigning all undo records that are associated with a first resource to a first set of undo records; and assigning all undo records that are associated with a second resource to a second set of undo records.

36. (New) The computer-readable storage medium of Claim 35, wherein: the step of assigning all undo records that are associated with the first resource includes the step of linking in a first chain undo records

that contain changes that are associated with the first resource; and

the step of assigning all undo records that are associated with the second resource includes the step of linking in a second chain undo records that contain changes that are associated with the second resource.

37. (New) The computer-readable storage medium of

Claim 36, wherein:

the step of linking in the first chain undo records that contain changes that are associated with the first resource includes the step of generating a first block-based undo chain, wherein the first block-based undo chain contains undo records that contain changes that need to be applied to the first resource; and

the step of linking in the second chain undo records that contain changes that are associated with the second resource includes the step of generating a second block-based undo chain, wherein the second

block-based undo chain contains undo records that contain changes that need to be applied to the second resource.

38. (New) A computer-readable storage medium storing one or more sequences of instructions for linking undo records, wherein execution of the one or more sequences of instructions by one or more processors causes the one or more processors to perform the steps of:

identifying an undo record, wherein the undo record contains change information that is associated with a particular resource;

linking the undo record into an undo record chain, wherein the undo record chain contains only undo records that contain change information that is associated with the particular resource; and wherein the step of linking the undo record includes

generating identifying data in at least one of the records in the undo record chain or in the undo record, wherein said identifying data once generated identifies a particular record in the undo record chain.

39. (New) The computer-readable storage medium of claim 38, wherein:

the step of identifying the undo record includes the step of identifying an undo record that contains change information that is associated with a particular data block; and

the step of linking the undo record into the undo record chain, includes the step of linking the undo record into the undo record chain, wherein the undo record chain contains only undo records that contain change information that is associated with the particular data block.

40. (New) The computer-readable storage medium of

claim 38, the steps further comprising:

identifying a first undo record, wherein relative to the undo record chain the first undo record contains the least recent change information that needs to be applied to the particular resource;

and

linking a pointer in the first undo record to the undo record chain.

41. (New) The computer-readable storage medium of claim 38, the steps further comprising: identifying a last undo record, wherein relative to the undo record chain the last undo record contains the most recent change information that needs to be applied to the particular resource; and

linking a pointer in the last undo record to the undo record chain.

42. (New) The computer-readable storage medium of claim 38, wherein the undo record chain contains only undo records that contain change information that needs to be applied to the particular resource.

43. (New) A computer-readable storage medium storing one or more sequences of instructions for recovering after failure of a transaction, wherein execution of the one or more sequences of instructions by one or more processors causes the one or more processors to perform the steps of: prior to said failure, storing in a first recovery record data that reflects a first change made by the transaction to a first resource; after making said first change and prior to said failure, storing in a second recovery record data that reflects a second change by the transaction to a second resource; after making said second change and prior to said failure, storing in a third recovery record data that reflects a third change to said first resource; after said failure, recovering said transaction; and wherein the step of recovering said transaction includes applying said data in said first recovery record and said data in said third recovery record prior to applying said data in said second recovery record.

44. (New) The computer-readable storage medium of

claim 43, wherein:

the step of storing in a first recovery record

comprises the step of storing in a first undo  
record;

the step of storing in a second recovery record

comprises the step of storing in a second undo  
record;

the step of storing in a third recovery record

comprises the step of storing in a third undo  
record; and

the step of applying said data comprises the step of

applying said data in said first undo record and  
said data in said third undo record prior to  
applying said data in said second undo record.